

## **FINAL REPORT**

Limited Scope Indoor Air Quality Survey  
SSMC III

for

National Oceanic & Atmospheric Administration

Interagency Agreement #: D8H3CO31200  
Tank: NOAA 99-0-26

September 2, 2004

Prepared by:  
U.S. Public Health Service  
Division of Federal Occupational Health  
Bethesda Central Office

## **Executive Summary**

At the request of the National Oceanic & Atmospheric Administration (NOAA), Federal Occupational Health (FOH) collected indoor air quality measurements for temperature, relative humidity, carbon dioxide, carbon monoxide, and airborne fungal spores throughout building SSMC-3, located at 1315 East-West Highway, Silver Spring, Maryland. Measurements were taken on July 12–16, 2004 following the methodology described below.

Temperatures throughout the building over the time period ranged from 70.9 to 76.8°F. Indoor relative humidity ranged from 42.6 to 52.6 percent.

Current guidelines of the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 55-1995 (Thermal Environmental Conditions for Human Occupancy) recommend temperatures in the range of 68 to 75°F in the winter and 73 to 79°F in the summer, along with maintaining 30 to 60 percent relative humidity. These ranges are based on a dissatisfaction criterion.

Carbon dioxide measurements provide an indicator of available “fresh air” in the space. Current standards (AIHA) describe indoor carbon dioxide levels below 850 parts per million (ppm), or no greater than a 700 ppm differential between outside and inside air concentrations (ASHRAE 62-1999) as generally acceptable. Carbon dioxide measurements throughout the building ranged 436 to 667 ppm. Carbon dioxide measured outdoors ranged from 400 to 410 ppm.

Carbon monoxide measurements recorded ranged from 0 to 1 ppm. The permissible exposure limit (PEL) for CO is 50 ppm. The “Industrial Hygienist’s Guide to Indoor Air Quality Investigations” published by the American Industrial Hygiene Association, Technical Committee on Indoor Environmental Quality cites less than 9 ppm average as acceptable. There were no combustion sources in the building to cause elevated CO, and outdoor measurements were 0 ppm.

With regard to microbial sampling, indoor fungal levels were generally lower than those of outdoors and fungi detected indoors were similar to those detected outdoors.

## **Introduction**

At the request of NOAA, FOH performed a limited scope indoor air quality investigation of Building SSMC-III, located at 1315 East-West Highway, Silver Spring, Maryland. The investigation took place on July 12–16, 2004. Evaluation methodologies and results are presented below.

## **Evaluation Methods**

Measurements of temperature, relative humidity, carbon monoxide, and carbon dioxide were taken in eight locations on each floor of the building as indicators of relative indoor air quality using a TSI Q Trak IAQ monitor, model 8550/8551. Each floor was designated into two zones, one on each side of the elevator lobby. Four measurements were taken in each zone in randomly selected locations on the interior and exterior of the floor.

Air samples for fungal contamination were collected by a culturable method using Andersen N-6 samplers at a flow rate of 28.3 liters per minute (L/min). Indoor Andersen air samples were collected for five minutes and outdoor samples were collected for both three and five minutes. Two percent (2%) malt extract agar (MEA) was used to recover general fungi. All plates were incubated in a 25°C incubator and examined every other day for up to 10 days to ensure the full recovery of fungi. Fungal identification was based on colony morphology, spores, and conidia formation. Total fungal colonies formed on each plate were counted and recorded. Fungal levels in samples were presented as colony forming units (CFUs) per measuring unit.

### **Standards/Criteria**

The IAQ Assessment followed general guidelines specified by the U.S. Environmental Protection Agency (EPA) "Building Air Quality" Guide for Building Owners and Facility Managers, and the "Industrial Hygienist's Guide to Indoor Air Quality Investigations" published by the American Industrial Hygiene Association, Technical Committee on Indoor Environmental Quality.

ASHRAE Standard 55-1995 (Thermal Environmental Conditions for Human Occupancy) recommends temperatures in the range of 68 to 75°F in winter and 73 to 79°F in summer. These ranges are based on a 10 percent dissatisfaction criterion. The recommended relative humidity range is 30 to 60 percent.

Carbon monoxide (CO) levels should remain <9 ppm on average ("Industrial Hygienist's Guide to Indoor Air Quality Investigations" published by the American Industrial Hygiene Association, Technical Committee on Indoor Environmental Quality). The PEL for CO is 50 ppm.

Carbon dioxide levels should remain at <850 ppm ("Industrial Hygienist's Guide to Indoor Air Quality Investigations" published by the American Industrial Hygiene Association, Technical Committee on Indoor Environmental Quality). ASHRAE 62-1999 recommends indoor carbon dioxide levels no greater than 700 ppm higher than outdoor levels (outdoor levels generally range from 300 to 500 ppm).

There are no "standards" for microbial burden. Complaint areas are generally compared with non-complaint areas and outside air.

### **Results and Conclusions**

Temperature, relative humidity, carbon dioxide, and carbon monoxide measurements by location are tabulated in Attachment A.

Microbial results are tabulated in Attachments A and B.

Temperatures throughout the building over the time period ranged from 70.9 to 76.8°F. Indoor relative humidity ranged from 42.6 to 52.6 percent. There were temperature and relative humidity measurements that fell outside the ASHRAE guidelines. Sample locations where these measurements were collected can be found in Attachment A.

Carbon dioxide measurements provide an indicator of available “fresh air” in the space. Current standards (AIHA) describe indoor carbon dioxide levels below 850 ppm, or no greater than a 700 ppm differential between outside and inside air concentrations (ASHRAE 62-1999) as generally acceptable. Carbon dioxide measurements throughout the building ranged from 436 to 667 ppm. Carbon dioxide measured outdoors ranged from 400 to 410 ppm.

Carbon monoxide measurements ranged from 0 to 1 ppm. The PEL for CO is 50 ppm. The “Industrial Hygienist’s Guide to Indoor Air Quality Investigations” published by the American Industrial Hygiene Association, Technical Committee on Indoor Environmental Quality cites an average of less than nine as acceptable. There were no combustion sources in the building to cause elevated CO levels and outdoor measurements were 0 ppm.

With regard to microbial sampling, indoor fungal levels were generally lower than those of outdoors and fungi detected indoors were similar to those detected outdoors.

## **Recommendations**

Based upon this limited scope investigation:

1. Ensure that the heating, ventilation, and air conditioning (HVAC) system is routinely maintained and inspected to ensure all components are operating properly and that fresh air is adequately distributed to occupied spaces.
2. Recommend routine visual inspections of the building to detect any water intrusion from outdoors or water leaks originating from indoor plumbing.

USPHS DFOH ENVIRONMENTAL MICROBIOLOGY LABORATORY  
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**LABORATORY REPORT #NOAA-04-IAQ-4R**

Client agency: National Oceanic and Atmospheric Administration, Silver Spring, MD  
**POIS#/task #: D8H04CO31200 / 99-004**

**Sampling dates: 7/15/04 – 7/19/04**

Dates of inoculation: 7/15/04 – 7/19/04

General location: Silver Spring, MD

Specific location: Building 3 (SSMC-3)

**Sampling technique: Air (Andersen N-6 sampler) sampling**

**Medium used: Malt extract agar (MEA) for fungi**

**Samples submitted by: K. Muse, M. Mazzaino, and R. Lopez**

**Date characterization completed: 7/29/04**

Air Samples on MEA plates

Sample ID	Sample Date	Sampling Location	Air Volume (L)	Fungi on MEA @ 25 C
MEA-3-2-071504-01	7/15/04	2 <sup>nd</sup> floor, Break room (adjacent)	84.9	1. <i>Cladosporium</i> (5*) 2. <i>Aureobasidium</i> (2)  $^{3}$ CFU/m = 82**
MEA-3-2-071504-02	7/15/04	2 <sup>nd</sup> floor, Library near 016-525.83	84.9	1. <i>Cladosporium</i> (1)  $^{3}$ CFU/m = 12
MEA-3-2-071504-03	7/15/04	2 <sup>nd</sup> floor, East corner (library)	84.9	1. <i>Cladosporium</i> (3) 2. <i>Penicillium</i> (1)  $^{3}$ CFU/m = 47
MEA-3-2-071504-04	7/15/04	2 <sup>nd</sup> floor, Across from bookcase (reference)	84.9	1. <i>Cladosporium</i> (1) 2. Basidiomycetes (2)  $^{3}$ CFU/m = 35
MEA-3-1-071504-01	7/15/04	1 <sup>st</sup> floor, Employees work life center	84.9	1. <i>Cladosporium</i> (13) 2. <i>Penicillium</i> (2) 3. <i>Alternaria</i> (1) 4. <i>Neurospora</i> (1) 5. Basidiomycetes (2)  $^{3}$ CFU/m = 224

Sample ID	Sample Date	Sampling Location	Air Volume (L)	Fungi on MEA @ 25 C
MEA-3-1-071504-02	7/15/04	1 <sup>st</sup> floor, Security / metal detector	84.9	1. <i>Cladosporium</i> (19) 2. <i>Penicillium</i> (2) 3. <i>Aspergillus sp.</i> (1) 4. <i>Epicoccum</i> (1) 5. Basidiomycetes (1)
MEA-3-1-071504-03	7/15/04	1 <sup>st</sup> floor, Elevator lobby	84.9	<sup>3</sup> CFU/m = 294 1. <i>Cladosporium</i> (19) 2. <i>Aureobasidium</i> (4) 3. <i>Penicillium</i> (4) 4. <i>Epicoccum</i> (2) 5. <i>Rhizopus</i> (1)
MEA-3-1-071504-04	7/15/04	1 <sup>st</sup> floor, Cafeteria by tray out	84.9	<sup>3</sup> CFU/m = 365 1. <i>Cladosporium</i> (6) 2. <i>Penicillium</i> (4) 3. <i>Scopulariopsis</i> (1)
MEA-3-out-071504-01	7/15/04	Outside, Outside building 1313	84.9	<sup>3</sup> CFU/m = 130 1. <i>Cladosporium</i> (85) 2. <i>Penicillium</i> (7) 3. <i>Alternaria</i> (5) 4. <i>Aspergillus sp.</i> (4) 5. <i>Aureobasidium</i> (3) 6. <i>Epicoccum</i> (2) 7. <i>Aspergillus niger</i> (1) 8. <i>Neurospora</i> (1) 9. Basidiomycetes (3)
				<sup>3</sup> CFU/m = 1,366

Sample ID	Sample Date	Sampling Location	Air Volume (L)	Fungi on MEA @ 25 C
MEA-3-out-071504-02	7/15/04	Outside, Outside building 1313	84.9	<ol style="list-style-type: none"> <li>1. <i>Cladosporium</i> (66)</li> <li>2. <i>Aureobasidium</i> (9)</li> <li>3. <i>Ulocladium</i> (4)</li> <li>4. <i>Alternaria</i> (2)</li> <li>5. <i>Aspergillus</i> sp. (1)</li> <li>6. <i>Chaetomium</i> (1)</li> <li>7. <i>Neurospora</i> (1)</li> <li>8. <i>Paecilomyces</i> (1)</li> <li>9. <i>Penicillium</i> (1)</li> <li>10. <i>Syncephalastrum</i> (1)</li> <li>11. Basidiomycetes (2)</li> </ol> <p><sup>3</sup> CFU/m = 1,190</p>
MEA-3-out-071504-03	7/15/04	Outside, Outside building 1313	84.9	<ol style="list-style-type: none"> <li>1. <i>Cladosporium</i> (48)</li> <li>2. <i>Penicillium</i> (5)</li> <li>3. <i>Alternaria</i> (4)</li> <li>4. <i>Aureobasidium</i> (3)</li> <li>5. <i>Epicoccum</i> (2)</li> <li>6. <i>Ulocladium</i> (2)</li> <li>7. <i>Aspergillus niger</i> (1)</li> <li>8. <i>Aspergillus</i> sp. (1)</li> <li>9. Basidiomycetes (2)</li> </ol> <p><sup>3</sup> CFU/m = 883</p>
MEA-3-5-071504-01	7/15/04	5 <sup>th</sup> floor, Adjacent to 5200	84.9	<ol style="list-style-type: none"> <li>1. <i>Aspergillus</i> sp. (2)</li> <li>2. <i>Cladosporium</i> (1)</li> <li>3. <i>Penicillium</i> (1)</li> </ol> <p><sup>3</sup> CFU/m = 47</p>
MEA-3-5-071504-02	7/15/04	5 <sup>th</sup> floor, Near cubicle 5637	84.9	<ol style="list-style-type: none"> <li>1. <i>Penicillium</i> (1)</li> </ol> <p><sup>3</sup> CFU/m = 12</p>
MEA-3-5-071504-03	7/15/04	5 <sup>th</sup> floor, Adjacent to 5123	84.9	<ol style="list-style-type: none"> <li>1. <i>Cladosporium</i> (5)</li> <li>2. <i>Aspergillus</i> sp. (1)</li> <li>3. <i>Paecilomyces</i> (1)</li> </ol> <p><sup>3</sup> CFU/m = 82</p>

MEA-3-5- 071504-04	7/15/04	5 <sup>th</sup> floor, Outside room 5863	84.9	1. <i>Aspergillus</i> sp. (1) 2. <i>Paecilomyces</i> (1)
MEA-3-4- 071504-01	7/15/04	4 <sup>th</sup> floor, Right corner	84.9	<sup>3</sup> CFU/m = 24 1. <i>Cladosporium</i> (1)
MEA-3-4- 071504-02	7/15/04	4 <sup>th</sup> floor, Inside cubicle 4735	84.9	<sup>3</sup> CFU/m = 12 1. <i>Cladosporium</i> (2)
MEA-3-4- 071504-03	7/15/04	4 <sup>th</sup> floor, Adjacent to women's bath	84.9	<sup>3</sup> CFU/m = 24 1. <i>Cladosporium</i> (1) 2. <i>Penicillium</i> (1)
MEA-3-4- 071504-04	7/15/04	4 <sup>th</sup> floor, Outside 4EL1	84.9	<sup>3</sup> CFU/m = 24 1. <i>Aspergillus</i> sp. (1) 2. <i>Penicillium</i> (1) 3. <i>Ulocladium</i> (1)
MEA-3-3- 071504-01	7/15/04	3 <sup>rd</sup> floor, Adjacent to 3300	84.9	<sup>3</sup> CFU/m = 35 1. <i>Penicillium</i> (7) 2. <i>Cladosporium</i> (2) 3. <i>Aspergillus</i> sp. (1)
MEA-3-3- 071504-02	7/15/04	3 <sup>rd</sup> floor, Outside room 3657	84.9	<sup>3</sup> CFU/m = 118 1. <i>Penicillium</i> (3)
MEA-3-3- 071504-03	7/15/04	3 <sup>rd</sup> floor, Mailroom	84.9	<sup>3</sup> CFU/m = 35 1. <i>Penicillium</i> (7) 2. <i>Cladosporium</i> (2)
MEA-3-3- 071504-04	7/15/04	3 <sup>rd</sup> floor, Outside room 3712	84.9	<sup>3</sup> CFU/m = 106 1. <i>Aureobasidium</i> (2) 2. <i>Cladosporium</i> (2) 3. <i>Paecilomyces</i> (1)
				<sup>3</sup> CFU/m = 59

Fungi on MEA @ 25 C					
Sample ID	Sample Date	Sampling Location	Air Volume (L)		
MEA-3-15-071604-01	7/16/04	15 <sup>th</sup> floor, Across from 15132	84.9	1. <i>Aspergillus</i> sp. (1) 2. <i>Cladosporium</i> (1) 3. <i>Ulocladium</i> (1)	$\text{CFU/m}^3 = 35$
MEA-3-15-071604-02	7/16/04	15 <sup>th</sup> floor, Office #15871A	84.9	1. <i>Cladosporium</i> (4) 2. <i>Penicillium</i> (1) 3. Basidiomycetes (4)	$\text{CFU/m}^3 = 106$
MEA-3-15-071604-03	7/16/04	15 <sup>th</sup> floor, Office #15876	84.9	1. <i>Aureobasidium</i> (1)	$\text{CFU/m}^3 = 12$
Fungi on MEA @ 25 C					
MEA-3-14-071604-01	7/16/04	14 <sup>th</sup> floor, Office #14400	84.9	1. <i>Aureobasidium</i> (1) 2. <i>Cladosporium</i> (1)	$\text{CFU/m}^3 = 24$
MEA-3-14-071604-02	7/16/04	14 <sup>th</sup> floor, Office #14239	84.9	No fungal growth	$\text{CFU/m} < 12$
MEA-3-14-071604-03	7/16/04	14 <sup>th</sup> floor, Conference room #14836	84.9	1. <i>Cladosporium</i> (1)	$\text{CFU/m}^3 = 12$
MEA-3-14-071604-04	7/16/04	14 <sup>th</sup> floor, Office #14716	84.9	1. <i>Cladosporium</i> (2)	$\text{CFU/m}^3 = 24$
MEA-3-13-071604-01	7/16/04	13 <sup>th</sup> floor, Office #13401	84.9	1. <i>Cladosporium</i> (4) 2. <i>Ulocladium</i> (1)	$\text{CFU/m}^3 = 59$
MEA-3-13-071604-02	7/16/04	13 <sup>th</sup> floor, Office #13319	84.9	1. <i>Cladosporium</i> (1) 2. sterile fungi (1)	$\text{CFU/m}^3 = 24$

MEA-3-13-071604-03	7/16/04	13 <sup>th</sup> floor, Office #13871	84.9	1. <i>Cladosporium</i> (8) 2. <i>Neurospora</i> (1) 3. <i>Penicillium</i> (1)
MEA-3-13-071604-04	7/16/04	13 <sup>th</sup> floor, Office #13734	84.9	<sup>3</sup> CFU/m = 118 1. <i>Cladosporium</i> (1)
MEA-3-12-071604-01	7/16/04	12 <sup>th</sup> floor, Office #12540	84.9	<sup>3</sup> CFU/m = 12 1. <i>Cladosporium</i> (4) 2. yeast (1)
MEA-3-12-071604-02	7/16/04	12 <sup>th</sup> floor, Office #12306	84.9	<sup>3</sup> CFU/m = 59 No fungal growth CFU/m < 12
MEA-3-12-071604-03	7/16/04	12 <sup>th</sup> floor, Office #12103	84.9	1. <i>Penicillium</i> (1)
MEA-3-12-071604-04	7/16/04	12 <sup>th</sup> floor, Office #13858	84.9	<sup>3</sup> CFU/m = 12 1. <i>Aureobasidium</i> (1)
MEA-3-11-071904-01	7/19/04	11 <sup>th</sup> floor, Outside cubicle 11460	84.9	<sup>3</sup> CFU/m = 12 1. <i>Cladosporium</i> (1)
MEA-3-11-071904-02	7/19/04	11 <sup>th</sup> floor, Outside cubicle 11224	84.9	<sup>3</sup> CFU/m = 12 No fungal growth CFU/m < 12
MEA-3-11-071904-03	7/19/04	11 <sup>th</sup> floor, Conference room 11817	84.9	No fungal growth CFU/m < 12
MEA-3-11-071904-04	7/19/04	11 <sup>th</sup> floor, Next to cubicle 11621	84.9	No fungal growth CFU/m < 12
MEA-3-10-071904-01	7/19/04	10 <sup>th</sup> floor, Inside cubicle 10456	84.9	1. <i>Aspergillus</i> sp. (1)
MEA-3-10-071904-02	7/19/04	10 <sup>th</sup> floor, Inside cubicle 10221	84.9	<sup>3</sup> CFU/m = 12 1. <i>Alternaria</i> (1)
				<sup>3</sup> CFU/m = 12

<b>Sample ID</b>	<b>Sample Date</b>	<b>Sampling Location</b>	<b>Air Volume (L)</b>	<b>Fungi on MEA @ 25 °C</b>
MEA-3-10-071904-03	7/19/04	10 <sup>th</sup> floor, Conference room 10836	84.9	1. <i>Aspergillus</i> sp. (1) 2. <i>Penicillium</i> (1)  $\text{CFU/m}^3 = 24$
MEA-3-10-071904-04	7/19/04	10 <sup>th</sup> floor, Adjacent to 10746	84.9	1. <i>Aureobasidium</i> (1)  $\text{CFU/m}^3 = 12$
MEA-3-9-071904-01	7/19/04	9 <sup>th</sup> floor, Between cubicles 9450 & 9452	84.9	1. <i>Penicillium</i> (1)  $\text{CFU/m}^3 = 12$
MEA-3-9-071904-02	7/19/04	9 <sup>th</sup> floor, Between cubicles 9218 & 9149	84.9	1. <i>Aspergillus versicolor</i> (1) 2. <i>Cladosporium</i> (1) 3. <i>Penicillium</i> (1)  $\text{CFU/m}^3 = 35$
MEA-3-9-071904-03	7/19/04	9 <sup>th</sup> floor, Inside conference room 9836	84.9	1. <i>Cladosporium</i> (1) 2. <i>Penicillium</i> (1)  $\text{CFU/m}^3 = 24$
MEA-3-9-071904-04	7/19/04	9 <sup>th</sup> floor, Adjacent to cubicle 9718	84.9	1. <i>Cladosporium</i> (1)  $\text{CFU/m}^3 = 12$
MEA-3-8-071904-01	7/19/04	8 <sup>th</sup> floor, Between cubicles 8458 & 8460	84.9	1. Ascomycetes (1)  $\text{CFU/m}^3 = 12$
MEA-3-8-071904-02	7/19/04	8 <sup>th</sup> floor, Across from cubicles 8140 & 8141	84.9	No fungal growth $\text{CFU/m} < 12$
MEA-3-8-071904-03	7/19/04	8 <sup>th</sup> floor, Conference room 8836	84.9	1. <i>Cladosporium</i> (1)  $\text{CFU/m}^3 = 12$
MEA-3-8-071904-04	7/19/04	8 <sup>th</sup> floor, Adjacent to cubicle 8753	84.9	No fungal growth $\text{CFU/m} < 12$

MEA-3-7-071904-01	7/19/04	7 <sup>th</sup> floor, Adjacent to cubicle 7564	84.9	1. <i>Penicillium</i> (2) 2. <i>Cladosporium</i> (1)
MEA-3-7-071904-02	7/19/04	7 <sup>th</sup> floor, Adjacent to cubicles 7229 & 7307	84.9	<sup>3</sup> CFU/m = 35 No fungal growth CFU/m < 12
MEA-3-7-071904-03	7/19/04	7 <sup>th</sup> floor, Conference room 7836	84.9	1. <i>Penicillium</i> (1)
MEA-3-7-071904-04	7/19/04	7 <sup>th</sup> floor, Next to cubicle 7746	84.9	<sup>3</sup> CFU/m = 12 No fungal growth CFU/m < 12
MEA-3-6-071904-01	7/19/04	6 <sup>th</sup> floor, Outside cubicle 6458	84.9	No fungal growth CFU/m < 12
MEA-3-6-071904-02	7/19/04	6 <sup>th</sup> floor, Reception area #6212	84.9	No fungal growth CFU/m < 12
MEA-3-6-071904-03	7/19/04	6 <sup>th</sup> floor, Conference room #6812	84.9	No fungal growth CFU/m < 12

Sample ID	Sample Date	Sampling Location	Air Volume (L)	Fungi on MEA @ 25 C
MEA-3-6-071904-04	7/19/04	6 <sup>th</sup> floor, Outside Cubicle #6752	84.9	1. <i>Cladosporium</i> (3) <sup>3</sup> CFU/m = 35

\* Colony counts.

\*\* Corrected particle counts were used for calculation of colony forming unit per cubic meter of air.